US-79-3-D10

CONCORDIA UNIVERSITY

April 9, 1979

MEMO TO: Mr. John Noonan
Secretary of Senate

FROM: Robert E. Wall
Chairman,
Arts and Science Faculty Council

Enclosed please find the documents entitled "Proposal for a Science College" and "Science College Curriculum" for the consideration of the members of Senate.

The documents were approved by the members of the Arts and Science Council at a meeting held on April 6, 1979.

Robert E. Wall

REW/cb

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PROPOSAL FOR A SCIENCE COLLEGE (ASC79-4-D3)

SCIENCE COLLEGE CURRICULUM (ASC79-4-D5)

Approved by:

Arts and Science Faculty Council

on

April 6, 1979

PROPOSAL FOR A SCIENCE COLLEGE

From the
Science College Planning Committee

P. Bird
W. Byers
M.J. Kornblatt
E. Maly
D. McLaughlin
S, Mullett
P. Shizgal
J. Stewart
D.H. Wheeler
E.B. Newman, Chairperson

GENERAL DESCRIPTION OF THE SCIENCE COLLEGE

The Science College program is conceived as an integrated education in science for a limited number of outstanding students. Science education, as such, does not generally exist at the level of the university. Students are educated in one discipline or another, but are not encouraged to consider the nature of science itself, or the relationships between disciplines. The Science College Committee considers that students are already provided a satisfactory grounding within their chosen discipline. It has therefore devoted its plans to other sorts of material with which it feels a science graduate should be acquainted.

The goal of the Science College is to produce a thinking, articulate student, independent and self-motivated, with a respect for intellectual achievement, a profound understanding of a chosen discipline, a reasonable literacy in other branches of science, and a sense of the position of the scientific undertaking in the context of human experience.

We propose for these purposes a set of courses and a number of extracurricular activities. The courses constitute the electives of a student who is following a major, specialization or honours program in the departments of biology, chemistry, geology, mathematics, physics or psychology, leading to a B.Sc. degree.

For students wishing to study science journalism, we also propose a program consisting of 36 credits in the Science College and 30 credits in journalism.

Advantages of the Science College to the Concordia Community

Until recently, Concordia University, and its predecessors, Sir George Williams University and Loyola College, have had relatively little visibility in Canadian science. The Science College is expected to help change this image. It will help increase enrollment in Division III, and will attract particularly highly qualified students. This will complement the efforts being made at graduate and research levels, achieving a new reputation for Concordia science.

Since the Science College is planned as a set of courses to complement departmental programs, it will provide to departments a number of very competent students. It will also allow for interaction between staff members in different departments and perhaps lead to some other elements of cooperation between departments. For a very limited number of students in science journalism, it will provide training in a specialty much needed by our society.

The existence of a core of gifted students on the Concordia campus will also provide a nucleus around which events of interest to the entire community of Division III can be arranged. The existence of the Science College should increase the awareness of science of the whole university community. Indeed the college, once established, may sponsor activities aimed at non-scientists, and take an active role in providing opportunities for all students to acquire the knowledge and understanding of science that is needed in the world today.

The curriculum of the Science College represents a considerable departure from the usual university curriculum. Many institutions have discussed how to teach science to non-science majors, but very few have considered how to inform students in any one discipline as to the nature of the other disciplines (area 1). Independent study is frequently seen as a final year honours

project, but is rarely found in the first and second years (area 2). While some course in history and philosophy of science is found in every university curriculum a reworking of these ideas so as to present an integrated course of study directed to the most capable of science students has not been attempted (area 3). We expect that this approach will be of interest to other institutions, and will add to our reputation for academic innovation.

SCIENCE COLLEGE COURSES
General Description

Area 1. The Content of Science

At the university as presently organized, a student follows a course of study in one discipline with only such supporting courses in other disciplines as may be related to that main course of study. Any acquaintance with the content of other disciplines is derived from introductory, and often pre-university, courses: indeed advanced level survey courses do not exist. To counteract this, the Science College proposes to offer one three-credit course contrasting the styles of various disciplines; and four three-credit "Topics in Science" courses.

Area 2. Independent Study

Most students complete their university career without ever being responsible for an intellectual endeavour of any scope, though some of our honours students do an independent project in their final year. We believe that even this is insufficient. We think that the goal of graduating a thinking, articulate student with an independent mind is best served by making the student responsible for some part of the content of the student's own intellectual experience. This confrontation of an intellectual problem with continuing discussion with an advisor, is to be part of the program from the first year.

Area 3. Science as it Relates to other Human Endeavours

The emergence of the scientific method of thought has greatly influenced the form of the modern world. We want our students to understand both the strengths and the limitations of their tradition, and to have some idea of its relation to the other aspects of our civilization. This material is to be organized in terms of the interests and competence of the students in the Science College.

SCIENCE COLLEGE COURSES

Detailed Description

AREA 1.

SCOL C200 Topics for Multidisciplinary Study (3 credits)

The purpose of this course is to introduce students to the multiple levels at which a scientific problem can be understood. They will have the opportunity to study the interplay between scientific disciplines, the factors that distinguish the dominant approaches in each field, and the common qualities of the sciences that mark them as part of the same enterprise.

The course will take one or more topics, and analyze them from the viewpoint of each of the disciplines. Representatives of each discipline will lecture on different aspects. The unique contribution that each field can make to the understanding of a problem will become apparent in this way.

This course will normally be taken in the first term of Year I.

Example of Course Material for S.C. 1

"How do we see?"

A physicist might tell us about the nature of light and the optics of the eye. Why is it that the nervous system is sensitive to that particular band of electromagnetic wavelengths? How is it that we can resolve images of objects both near and far? Why is vision more accurate when the pupil is constricted?

The chemistry of vision, in which George Wald did his Nobel prize-winning research, provides a well worked-out example of sensory transduction. By describing the changes in the photopigment that result from the absorption of light, and the reversal of these changes that allows the molecule to be re-used, the chemist would provide a case for how an understanding of molecules tells us something fundamental about every-day experience.

A biologist might discuss any number of topics ranging from the comparative to the mechanistic. One might analyse the visual systems of different creatures in terms of the selection pressures that guided their evolution. The physiology and anatomy of the visual system could be described with the intention of demonstrating how visual information is processed by neural circuits.

A psychologist might highlight basic perceptual phenomena such as the constancies. How is it that we perceive an approaching object as constant in size even though its retinal image grows? Why does an object not appear to change shape as we view it from different angles? How do we distinguish changes in a retinal image that are produced by movements of objects in the environment from changes caused by movements of the eye itself?

The topic of vision has long been studied mathematically. For example, one hotly contested model of pattern

perception holds that the visual system carries out a Fourier analysis of spatial frequencies. A mathematically based theory called signal detection claims to provide a means of separately measuring the contribution of sensory and motivational processes to the task of deciding whether an event (e.g. a flash of light) occurred. This theory makes it possible to base inferences about sensory processes on verbal data and is currently seeing wide application in areas such as the study of pain.

The visual system can also be construed as a triumph of engineering. One might describe the elegant servomechanism that links the acceleration-sensitive receptors of the inner ear to the eye muscles such that we can maintain a stable image of the world even when the head vibrates (e.g. when running or walking). An engineer might also account for the variable-gain amplification properties of the visual system that allow it to function well at light intensities ranging over ten orders of magnitude.

SCOL C250, C251, C252, C253 Surveys of Scientific Disciplines (3 credits each)

These courses will each survey one or two disciplines, these to include among others biology, chemistry, computer science, engineering, geology, mathematics, physics and psychology. A maximum of 6 credits will be scheduled in any academic year.

The form the courses will take varies a great deal with the particular discipline, and with the instructor. The goal is to indicate the nature of the problems dealt with by the discipline at present and in the recent past, its characteristic style(s) of analysis, and the directions in which it seems to be headed. This intent may best be understood, perhaps, by contrasting it with introductory survey courses which usually survey basic factual material which has been agreed upon for at least fifty years.

Because surveys of an entire discipline have not previously been taught, and because they will vary greatly with the field and with the instructor, no general model can be given. One specific outline is given, by way of illustration of the intent of these courses.

AREA 1.

Example of course material for SCOL C250

"On the nature of Biology"

The course will be organized in three sections - Section 1: What are the main concepts around which biological knowledge is structured, and how are they viewed by biologists with different backgrounds?

Section 2: How have the basic questions asked in biology a century ago diversified into different sub-disciplines today?

Section 3: What are the forces external to biology which govern the direction in which biological research progresses?

Section 1: The field of biology deals with material in terms of different levels of organization - molecules, organelles and cells; tissues, organs and organ systems; individuals; populations; communities and ecosystems. Lecturers from the fields of molecular biology, physiology and ecology will comment on these, indicating the areas with which they primarily tend to be involved.

Certain questions in biology will then be treated from the view of each stream of biology. Why is a columbine blue? The ecologist would discuss pollinators, soil composition; the biochemist-pigment biosynthesis; the physiologist, the timing of pigment synthesis and its location in the plant; the geneticist, plant breeding etc.

Section 2: The fragmentation of biology into subdisciplines has resulted in a considerable lack of understanding between molecular biologists and population biologists. This particular divergence can be traced back to the concept of mutation, as discussed by Darwin and Mendel. Mutation studied as a factor in population evolution led from Hardy and Weinberg, through mathematical analysis of populations to ecological

considerations. The chemical interest in the actual nature of the gene, followed the development of biochemical technique, and led to the present concentration on the regulation of gene expression at a molecular level.

From this common origin have arisen two fields with quite different outlooks,problems and interests. The difficulties of field work make it very hard to obtain reliable data, leading to an excess of "conceptualizers" unrestrained by fact. Molecular geneticists have been aided by technological advances and have tended to verify exceedingly specific hypotheses, but have avoided formulating general hypotheses.

Section 3: Apart from interests intrinsic to the field, many other factors: social, economic, and political, affect research in the biological sciences. Examples may be taken from the advance of molecular biology as a result of the desire to understand cancer; the understanding of physiology in general as a fight against disease; the present flowering of ecology as pollution problems present themselves.

SCOL C290; C390	Independent Study	3 credits each
SCOL C490	Independent Study	6 credits

Each student in the college will be expected to complete twelve credits of independent study, 3 in Year I, 3 in Year II, and 6 in Year III, the last 6 which may be a senior honours thesis in those departments which offer such a course.

In each of these units, the student will work under the supervision of a member of the faculty on either a practical laboratory project, or a literature study. The student will be encouraged to work in more than one field and with more than one person in the course of the three years. A formal written report, the nature of which will vary with the project undertaken, will be required.

AREA 3.

SCOL C270, C271 Historical, Philosophical and Social Aspects of Science 6 credits each

These courses will discuss the intellectual framework of science, and the relationships between science and society, the political and philosophical questions inherent in the scientific process. As these courses are intended for science students. they will rely heavily on primary sources. Students will be expected to understand the scientific issues at the level at which they were originally expressed.

Among the topics to be discussed are: the relation between scientific thinking and other modes of thought: ethical, religious, aesthetic; current epistemological considerations. The historical development of the scientific method; how did patterns of thought change during the development of science, and how are these changes reflected in society.

What is the relationship between science and society? Why does society support and encourage science? How far is science influenced by its social context? ideological uses and abuses of science. How do scientists actually proceed? What psychological factors influence scientific creativity? How are discoveries made? What is the relationship between science and technology? Who should make decisions as to the implementation of inventions? What sorts of responsibilities do scientists have?

1. Science College Curriculum

Most students in the Science College are expected to complete an honours, specialization, or majors program in the departments of biology, chemistry, geology, mathematics, physics or psychology. Their program will lead to a B.Sc. degree. These students are expected to complete 30 credits in the college, and to take part in a compulsory non-credit seminar in each year.

These 30 credits are made up of:

12 credits in Area 1	-	SCOL C200, and any 9 credits chosen from SCOL C250, C251, C252, C253
12 credits in Area 2	-	SCOL C290, C390, C490
6 credits in Area 3	-	SCOL C270

2. Science Journalism

Students interested in science journalism are expected to complete 36 credits in the college (the above 30 and (SCOL C271 and 30 credits in journalism.

OTHER MATTERS

1. College Seminar

A compulsory non-credit seminar will meet once weekly to discuss various topics of interest to the group, many to be derived from the discussions in courses of area 3. This seminar will draw on the experience of such visitors as are on campus in any year, and on the local scientific community of Montreal.

2. Competence in Oral and Written Presentations

One of the goals of the college is to turn out students who can express scientific ideas in the English language rather than in science. The college will feature regular opportunities for practice, and advice as to forms of communication useful for and acceptable to the scientific community.

3. Admissions

Admission to the college is to be based on "B" equivalent average in prior education, and staff evaluation, possibly including an interview. We envisage a class of 25 per year. An attempt will be made to have a distribution of students from each of the scientific disciplines, thus maintaining the opportunity for exchange of thought between the disciplines.

4. Students in the Science College as Tutors

Science College students will be expected to act as tutors for students in their departments, 2 hours per week, in two of their three years in the university. Advice for tutors will be provided by members of the college if the need should arise.

APPENDIX I

Workload Implications for Students

The committee has considered the various types of students who might enter this program, and the implications this program has on their workload.

Considering first honours students: honours programs in the relevant departments range from 60-72 credits with one at 75. Discussions with the chairpersons of the various departments have indicated that there is no difficulty in substituting 12 college credits for 12 credits in the 72-credit honours courses. This means that except for the students in the 75-credit program the number of credits required for the B.Sc. degree, including the Science College, will be 90 - as it is for other students in Arts and Science.

However it is nonetheless true that a program made up of 30 credits in the college and 60 credits in honours in a discipline will constitute a heavy program. The college will therefore be particularly careful as to the calibre of students it admits to this program.

The problem for specialization students is somewhat less severe, though the same sort of considerations will apply. The college committee thinks it likely that most of its students will wish to do a specialization or honours degree. However it recognizes that some very good students prefer to do a major and have a freer choice of courses. It therefore wishes to accept major students into the college, should they meet its academic requirements.

CURRICULUM COMMITTEE

SCIENCE COLLEGE CURRICULUM

for submission to

Arts and Science Faculty Council

April 6, 1979

DIVISION IV Department SCIENCE COLLEGE

NEW PROGRAMME PROPOSAL:
(Please submit copy as a complete undergraduate calendar entry.

CREDITS	TITLE
30	Science College Curriculum
3	SCOL C200[3]
9	Chosen from SCOL C250[3], C251[3], C252[3], C253[3]
12	SCOL C290[3], C390[3], C490[6]*
6	Chosen from SCOL C270[6], C271[6]
	Additionally all Science College students are required to attend the College Seminars held once weekly. College students will be expected to act as tutors for students in their departments for two hours per week in two of their three years in the University.
	* Students may replace SCOL C490[6] with a Departmental Honours Thesis (6 credits) or the equivalent.
	Students are responsible for satisfying their particular degree requirements by completing a departmental honours, specialization or major programme.

FACULTY OF ARTS AND SCIENCE FORM E

DIVISION [IV] Department SCIENCE COLLEGE

NEW PROGRAMME PROPOSAL:
(Please submit copy as a complete undergraduate calendar entry.

CREDITS	TITLE
66	BA Specialization in Science and Journalism
	Journalism:*
	YEAR I
12	JOUR C201^{6}, C205^{3}, C305^{3}
	YEAR II
9	JOUR C301^{6}, C405^{3}
	YEAR III
9	JOUR C401^{6}, C410^{3}
	Science College:
3	SCOL C200^{3}
9	Chosen from SCOL C250^{3}, C251^{3}, C252^{3}, C253^{3}
12	SCOL C290^{3}, C390^{3}, C490^{6}
12	SCOL C270^{6}, C271^{6}
	*NOTE: Students should note that there are special admission requirements for Journalism courses and must contact the Journalism office.
	All Science College students are required to attend the College Seminars held once weekly. College students will be expected to act as tutors for students in their departments for two hours per week in two of their three years in the University.

NEW COURSE PROPOSAL:

(Please submit copy as a complete undergraduate calendar entry.)

PROPOSED ENTRY
SCOL C200 Topics for Multidisciplinary Study Prerequisite: Membership in the Science College or permission of the College. The purpose of this course is to introduce students to the multiple levels at which a scientific problem can be understood. They will have the opportunity to study the interplay between scientific disciplines, the factors that distinguish the dominant approaches in each field and the common qualities of the sciences that mark them as part of the same enterprise. The course will take one or more topics and analyze them from the viewpoint of various disciplines. Representatives of the disciplines will lecture on the different aspects. The unique contribution made by each field to the understanding of a problem will in this way; become apparent. (3 credits)

NEW COURSE PROPOSAL:

(Please submit copy as a complete undergraduate calendar entry.)

PROPOSED ENTRY
SCOL C250 Survey of a Scientific Discipline I Prerequisite: Membership in the Science College or permission of the College. This course will survey one or two disciplines, these to include among others biology, chemistry, geology, computer science, engineering, mathematics, physics and psychology. The form of the course may vary according to the particular discipline. The goal is to indicate the nature of the problems dealt with by a discipline at present and in the recent past, its characteristic style(s) of analysis and the directions in which it seems to be headed. (3 credits)

NEW COURSE PROPOSAL:

(Please submit copy as a complete undergraduate calendar entry.)

PROPOSED ENTRY

SCOL C251

Survey of a Scientific Discipline II

Prerequisite: Membership in the Science College or permission of the College. This course will survey one or two disciplines, these to include/among others biology, chemistry, geology, computer science, engineering, mathematics, physics and psychology. The form of the course may vary according to the particular discipline. The goal is to indicate the nature of the problems dealt with by a discipline at present and in the recent past, its characteristic style(s) of analysis and the directions in which it seems to be headed. (3 credits)

NEW COURSE PROPOSAL:

(Please submit copy as a complete undergraduate calendar entry.)

PROPOSED ENTRY
SCOL C252 Survey of a Scientific Discipline III Prerequisite: Membership in the Science College or permission of the College. This course will survey one or two disciplines, these to include among others biology, chemistry, geology, computer science, engineering, mathematics, physics and psychology. The form of the course may vary according to the particular discipline. The goal is to indicate the nature of the problems dealt with by a discipline at present and in the recent past, its characteristic style(s) of analysis and the directions in which it seems to be headed. (3 credits)

NEW COURSE PROPOSAL:

(Please submit copy as a complete undergraduate calendar entry.)

PROPOSED ENTRY
SCOL C253 Survey of a Scientific Discipline IV Prerequisite: Membership in the Science College or permission of the College. This course will survey one or two disciplines, these to include/among others biology, chemistry, geology, computer science, engineering, mathematics, physics and psychology. The form of the course may vary according to the particular discipline. The goal is to indicate the nature of the problems dealt with by a discipline at present and in the recent past, its characteristic style(s) of analysis and the directions in which it seems to be headed. (3 credits)

NEW COURSE PROPOSAL:

(Please submit copy as a complete undergraduate calendar entry.)

PROPOSED ENTRY
SCOL C270 Historical Philosophical and Social Aspects of Science I Prerequisite: Membership in the Science College or permission of the College. This course will discuss the intellectual framework of science, and the relationships between science and society, the political and philosophical questions inherent in the scientific process. As these courses are intended for science students, they will rely heavily on primary sources. Students will be expected to understand the scientific issues at the level at which they were originally expressed. Among the topics to be discussed are: the relation between scientific thinking and other modes of thought: ethical, religious, aesthetic; current epistemological considerations. The historical development of the scientific method; how did patterns of thought change during the development of science, and how are these changes reflected in society. (6 credits)

NEW COURSE PROPOSAL:

(Please submit copy as a complete undergraduate calendar entry.)

PROPOSED ENTRY
SCOL C271 Historical, Philosophical and Social Aspects of Science II Prerequisite: Membership in the Science College or permission of the College. This course will discuss the intellectual framework of science, and the relationships between science and society, the political and philosophical questions inherent in the scientific process. As these courses are intended for science students, they will rely heavily on primary sources. Students will be expected to understand the scientific issues at the level at which they were originally expressed. Among the topics to be discussed are: the relation between scientific thinking and other modes of thought: ethical, religious, aesthetic; current epistemological considerations. The historical development of the scientific method; how did patterns of thought change during the development of science, and how are these changes reflected in society. (6 credits)

NEW COURSE PROPOSAL:

(Please submit copy as a complete undergraduate calendar entry.)

PROPOSED ENTRY
SCOL C290 Independent Study I Prerequisite: Membership in the Science College or permission of the College. The student will work under the supervision of a member of the faculty on either a practical laboratory project, or a literature study. A formal written report will be required. (3 credits)

NEW COURSE PROPOSAL:

(Please submit copy as a complete undergraduate calendar entry.)

PROPOSED ENTRY
SCOL C390 Independent Study II Prerequisite: Membership in the Science College or permission of the College. The student will work under the supervision of a member of the faculty on either a practical laboratory project, or a literature study. A formal written report will be required. Students will be encouraged to work in a different field from that of their SCOL C290 project. (3 credits)

NEW COURSE PROPOSAL:

(Please submit copy as a complete undergraduate calendar entry.)

PROPOSED ENTRY
SCOL C490 Independent Study III Prerequisite: Membership in the Science College or permission of the College. The student will work under the supervision of a member of the faculty on either a practical laboratory project, or a literature study. A formal written report will be required. Students will be encouraged to work in a different field from that of their SCOL C290 and C390 projects. (6 credits)

internal memorandum

TO: Tom Adley,
Assistant Dean

FR: Lindsay Crysler,
Journalism

DATE: March 23, 1979

Re: BA Specialization in Science-Journalism

I have discussed this proposal from the Science College with Prof. Elaine Newman and we agree that both the form and the intent of the course description would improved if it read:

BA Specialization in Science and Journalism.

This, we feel, better indicates to people outside the university that graduates of this program will have some specialist training in Science and in Journalism, but will not lead anybody to believe they have had some specific training in Science journalism.

The sequence of courses for the Journalism Minor portion of the study program would be:

Year I
JOUR C201, C205, C305.

Year II
JOUR C301, C405.

Year III
JOUR C401, C410.

(This employs the course numbers in the current Calendar. The numbers change, if the Journalism Major is approved, but that is easily remedied.)

Both the Science College and Journalism are interested in the proposed BA Specialization in Science and Journalism, and we look forward to coordinating some programs so that students from both fields of study may benefit.

L. C. March 23/79

cc- Prof. Newman.